Stationary states and dynamics of superconducting thin films

Ögren, Magnus; Sørensen, Mads Peter; Pedersen, Niels Falsig

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M. Ögren, M. P. Sørensen and N. F. Pedersen
Dep. of Mathematics, Technical University of Denmark, 2800 Kongens Lyngby, Denmark

Abstract
The Ginzburg-Landau (GL) theory is a celebrated tool for theoretical modelling of superconductors [1]. We elaborate on different partial differential equations (PDEs) and boundary conditions for GL theory, formulated within the finite element method (FEM) [2]. Examples of PDEs for the calculation of stationary states with the GL equation and with the time-dependent GL equation are given. Moreover we study real time evolution with the so called Schrödinger-GL equation [3]. For simplicity we here present numerical data for a two-dimensional rectangular geometry, but we emphasize that our FEM formulation can handle complex geometries also in a three-dimensional superconducting structure. To include external currents in our modelling we discuss the role of the boundary conditions for the external magnetic field [4]. Finally we show results for the pinning of vortices with controlled impurities.

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